

Diabetes Mellitus and Female Sexuality: a Review of 25 Years' Research

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Diabetes mellitus may cause debilitating somatic complications and a high psychosocial burden. Impaired sexual function (erectile dysfunction) is a well-established complication in men. Does diabetes also have an effect on sexuality of women? Since the first publication in 1971, only 15 studies in this area have been published and their results are contradictory. The purpose of this article is to offer a review of these results. As a conclusion, a new hypothesis on the specific influence of diabetes on female sexuality and suggestions for further research are formulated. © 1998 John Wiley & Sons, Ltd.

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Introduction

In Western societies, diabetes mellitus (DM) has a high prevalence. Based upon data from the United States of America, we estimate that about 300 000 men and women in Belgium have diabetes of whom about 30 000 will be Type 1.¹ Diabetes mellitus comprises a heterogeneous group of disorders² for which there is currently no cure. In dealing with diabetes, the goals are therefore two fold: maintenance of the well-being and quality of life of the affected individual and minimization of long-term complications.^{3,4} Apart from these somatic complications, there is growing interest in the influence of diabetes on psychological, psychosocial and psychosexual functioning.⁵ Diabetic men are recognized to be at risk for developing impaired sexual function and sexual research has mainly focused on sexual problems in diabetic men. But does diabetes also have an affect on the sexual function of women? To answer this question it is important first to call to mind a definition and classification of sexual dysfunctions. Since Masters and Johnson studied the sexual physiology, the physiology of the sexual response cycle has been considered to be divided in three successive stages: excitement, orgasm and resolution. Kaplan drew the attention to the psychological category of sexual desire that precedes these physiological processes and in research the physiological 'resolution phase' is often transformed into sexual satisfaction.⁶ Each of the phases of the sexual response cycle is dominated by different physiological reactions which means that any abnormality (neurological, vascular or endocrine) can result in an

impairment of one phase.⁷ But human sexuality is a complex phenomenon which involves not only biological but also psychological and socio-cultural aspects, with the result that sexual problems can also be provoked by psychological and/or relational factors. According to this theory on human sexuality it is possible to distinguish various sexual dysfunctions in women. There can be problems of sexual desire (libido); sexual arousability (vaginal lubrication as the counterpart of erection in man) necessary to engage in coitus; orgasmic capacity and sexual pain disorders (dyspareunia).^{6,8} We used this classification of sexual dysfunctions in our analysis of the literature concerning potential sexual dysfunction in diabetic women.

Methods

We have reviewed the available literature concerning the influence of diabetes on female sexual function. A search on Medline and Psychlit was carried out combining the following keywords: diabetes, women, sexuality, female sexuality, sexual problems, sexual (dys)function, (diabetic) complications. The search was not limited by imposing date ranges or other characteristics. From the references of each publication we extended the result of our search to 23 articles, of which 15 were research reports.^{9–24} The characteristics of the studies are shown in Table 1.

The available data in these study reports were analysed and organized according to the classification of sexual dysfunction described above. For each sexual problem, we give a definition and methodological remarks, followed by the findings in research. Based upon these data in the discussion a state of the art on diabetes and female sexuality was worked up and a new hypothesis

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Table 1. Study characteristics

Name	Year	Number	Source of patients	Control group	Age (years)	Diabetes type	Duration (years)
Kolodny	1971	125	hospitalized diabetic women	100 hospitalized non-diabetic women	18–42	?	x = 6;6
Montenero	1973	100	?	no	23–50	?	1–20
Ellenberg	1977	54	outpatients with neuropathy	46 outpatients without neuropathy	24–73	1 + 2	1–53
Zrustova and Rostlapil	1978	40	?	?	x = 49	?	x = 10
Jensen	1981	160	outpatients	80 patients seeing general practitioner	26–45	1	2–32
Tyrer	1983	82	outpatients	47 normal subjects	18–45	1	2–32
Jensen	1985	51	outpatients		26–45	1	
Schreiner–Engel	1985	50	outpatients	50 normal subjects	22–57	1 + 2	1–35
Jensen	1986	101	outpatients	101 longitudinal comparisons	26–45	1	2–32
Newman and Bertelson	1986	81	outpatients	43 diabetic patients with normal sexual function	18–50	1 + 2	x = 14;4
Schreiner–Engel	1987	55	outpatients	65 married controls	22–60	1 + 2	1–35
Campbell	1989	48	outpatients	no	x = 45	1 + 2	x = 10
Slob	1990	24	self selection	10 control women	23–48	1	0;2–10
Leedom	1991	27	outpatients	11 non-diabetic subjects	≤55	1 + 2	x = 13;4
Wincze	1993	14	advertisement	7 non-diabetic subjects	x = 26;4	1	?

on the specific influence of diabetes on the sexual response cycle in women has been formulated.

Results

Problems of Sexual Desire in Diabetic Women

Definition and Methodological Remarks

In general, sexual desire is defined as 'the motivation or wish to have a sexual experience, whether opportune or not'²⁵ and is often operationalized as, for example, desire in sexual activity, sexual fantasies, interest in sexual intercourse, frequency of intercourse, sexual drive or libido. In the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (DSM-IV), a 'hypoactive sexual desire disorder (HSD)' is defined as 'persistent or recurrently deficient (or absent) sexual fantasies and desire for sexual activity'.⁸ Sexual desire remains a notion difficult to qualify and quantify. For that reason, methodological flaws are prominent in research on sexual desire. First, although libido is often associated with sexual appetite or desire, in fact such a description of sexual desire remains vague.²⁶ Second, the lack of psychophysiological correlates leaves the diagnosis of sexual desire disorders based primarily on subjective criteria. Besides the questionable possibility of a good definition and a useful operationalization, a third question

arises. How often is HSD a primary problem and how often a secondary problem to problems with later phases in the sexual response cycle. Bancroft draws the attention to the difference between spontaneous sexual interest and sexual interest which arises once sexual interaction with the partner begins.²⁷ In most studies these distinctions between a primary or secondary HSD and between self-initiated and partner-initiated sexual desire are neglected; and even if more attention were to be given to these distinctions in research, because of the paucity of age- and sex-related normative information on sexual desire in a general population, a diagnosis of HSD remains arbitrary.

Findings in Research on Sexual Desire

Twelve authors^{9–17,20,21,23} have looked at 'sexual desire', most of them defining it differently. Despite the use of these different definitions, we assumed that sexual drive, interest in sexual intercourse, frequency of sexual intercourse, libido and sexual desire cover approximately the same aspects, so that the results of these studies are comparable.

Kolodny¹⁰ compared 125 hospitalized diabetic and 100 non-diabetic women using coital frequency and self-estimation as measures of sexual desire. He could not find a significant reduction of sexual interest in diabetic women. However, caution is indicated in interpreting these data because hospitalized diabetic

patients are more generally debilitated and/or have poorer diabetic control, producing a non-specific effect.¹⁴ Montenero also used the frequency of sexual intercourse in combination with a subjective measure and found that only 4 out of a group of 100 women with diabetes experienced a lack of sexual desire.¹⁰ In contrast to this very low percentage, Zrustova found a decrease of sexual desire in 45% of diabetic women.¹³ These extremes have never been replicated in later research. In a Danish study on the influence of chronic illness on sexuality, Jensen reported that 17 % of a control group had difficulties with sexual arousal.²⁹ In various studies where there was comparison to a control group, a non-significant trend of a decrease of sexual interest was found in 14 %, 20 %, 21 %, 24 % of diabetic women.^{11,12,15,16} Elsewhere^{16,20,23} there is evidence for a significantly decreased libido in diabetes in comparison to control. Schreiner-Engel suggested that there is a differential effect of diabetes type on sexual desire: a significant decrease of sexual desire being only apparent in Type 2 DM.²¹ Leedom stated that in a group of Type 1 and Type 2 DM patients, only women with neuropathy report significantly less desire.²⁴

Problems with Sexual Arousal in Diabetic Women

Definition and Methodological Remarks

Sexual arousal refers to a subjective sense of sexual excitement/pleasure that can be provoked by both psychological and physical stimulation. In the DSM-IV 'female sexual arousal disorders' are defined as 'a persistent or recurrent inability to attain, or to maintain until completion of the sexual activity, an adequate lubrication-swelling response of sexual excitement'.⁹ Research on sexual arousability of women is hampered by problems of different methodologies. First, different definitions are used, hindering comparability. Second, it is not easy to measure sexual arousal in women and even less easy to establish changes in sexual arousal. This is in contrast to men for whom a decrease of sexual arousal is demonstrated readily as a reduction in erectile capacity. Most studies on sexual arousal in diabetic women therefore rely solely on questionnaires or self-reported subjective sexual arousal, although many authors have admitted the limitations of this method.^{8,14,30} However, in order to study female sexual arousal 'objectively', it is important to complement the information of such questionnaires with more objective methods, such as labiothermometry or vaginal plethysmography. In such studies, women are asked to watch an erotic video while vaginal lubrication is measured. Third, there is an assumption in such research that somatic (genital) arousal and subjective (feelings of) arousal in women evolve simultaneously. However, Laan found that there is 'only some correlation between genital and subjective sexual arousal'.³¹ In contrast to men, genital arousal in women appears to be a bad predictor

for subjective arousal and *vice versa*. Laan therefore suggests that subjective as well as objective indications are necessary to 'measure' sexual arousal correctly. Only two studies^{23,25} report the use of both measures of sexual arousal. The others are only based on a subjective estimation of the arousal reactions.

Findings in Research on Sexual Arousal

All published studies^{10–25} deal with sexual arousal/excitement, using different descriptions. Some authors differentiate between genital and general arousal but do not clearly specify this.¹⁵ We assumed that vaginal lubrication, sexual arousal and sensibility to sexual intercourse could be interpreted as synonyms.

The results of studies based upon subjective self-reporting are very contradictory and range from 14 % to 45 % of diabetic women reporting a decrease of vaginal lubrication. Montenero concluded that the most affected element, isolated or associated with others, was sensibility, which means the capacity to respond to an erotic stimulus corresponding to erection in men.¹¹ Except in Kolodny's study with hospitalized patients (in which only 14 % of diabetic women reported difficulties with vaginal lubrication) a reduction in diabetes was confirmed in most other research. Zrustova found a lack of sensibility in sexual intercourse in 45 % of 40 diabetic women.¹³ Schreiner-Engel *et al.* found that 45 % of diabetic women reported a decrease in lubrication after the onset of diabetes.¹⁷ Tyrer mentioned that 34 % of the women reported problems with arousal¹⁵ and stated that such arousal problems were the only significant difference between diabetic patients and controls. In two other studies^{14,18} 24% and 32% of women with diabetes reported problems with vaginal lubrication or excitement. These percentages were significantly different from results in the control group and from estimations in the general population: Newman and Bertelson found that about 15 % of women in a control group experienced arousal problems,¹⁸ which is confirmation of results from a general population.³²

In summary, most of the subjective studies show evidence of significant differences between diabetic women and controls: women with diabetes are at double the risk of non-diabetic women for problems with sexual arousal.¹⁸

Only in two studies was subjective information complemented by objective measures of sexual arousal. Slob *et al.*²³ used labial thermometry and found no differences between objective and subjective arousal of women with diabetes; nor did he find differences in objective sexual arousal between diabetic women and controls. However, there were methodological difficulties. There was a large unexplained difference in basal temperature between diabetic women and controls, making it difficult to compare results between the experimental and the control group. Slob suggested that, in further research, it would be better to use other instruments, such as vaginal plethysmography, to measure female sexual

arousal objectively. Wincze reported a study with vaginal photoplethysmographic measures of capillary engorgement.²⁵ In agreement with Slob, he did not find differences in subjective arousal in response to erotic movies between diabetic and non-diabetic women, but in contrast to Slob he found significant differences in objective arousal. Wincze suggested that these findings support the hypothesis for a potential diabetes-related arousal dysfunction by a decrease of the vaginal lubrication of women with Type 1 diabetes.

Problems with Orgasm

Definition and Methodological Remarks

The phase of orgasm consists of a peaking of sexual pleasure with release of sexual tension and is characterized by a series of rhythmic contractions of the smooth muscles of internal reproductive organs and the striated musculature of the perineal floor.⁷ In contrast to men, there is greater variability in intensity and duration of the orgasmic phase in women.⁶ In the DSM-IV, a 'female orgasmic disorder' is defined as 'a persistent or recurrent delay in, or absence of, orgasm following a normal sexual excitement phase. ...The diagnosis of female orgasmic disorder is based on the clinician's judgement that the woman's orgasmic capacity is less than reasonable for her age, sexual experience, and the adequacy of sexual stimulation she receives'.⁸ The great individual variability in intensity and duration of the orgasmic phase in women means that research in this area relies mostly on subjective data and interpretation. Only questionnaires or interviews have been used to date. In this type of research, it is important to be aware that reaching an orgasm is dependent on a sufficiently long and appropriate stimulation. In enquiring, it is important to distinguish between an orgasm reached in sexual intercourse or with masturbation.¹⁶ Moreover, it is useful to correct for age, because of the taboo on sexuality of the past.

Findings in Research on Orgasm

We found 11 studies with data on the orgasmic phase.^{10,18,21,22,24} There was no problem with different definitions in research on orgasmic function. As for the other phases of the sexual response cycle the outcome of studies about orgasm is very contradictory. Kolodny found 'a complete absence of orgasmic response' in 35 % of a group hospitalized diabetic women,¹⁰ significantly different from 6 % in controls. A further analysis of these data demonstrated that the non-orgasmic controls had previously never had an orgasm but 91 % of the non-orgasmic diabetic women developed a secondary orgasmic dysfunction after the onset of diabetes. Zrustova *et al.* found that 32 % of diabetic women reported anorgasm.¹³ In a group of women with Type 2 diabetes, Schreiner-Engel found that 32 % reported more difficulties in reaching orgasm during intercourse in the last 7 months.²¹ Such strong evidence of the existence of problems with orgasm in diabetic women was not

replicated in other studies. Montenero found a decrease or absence of orgasm in only 1 %¹¹ and Jensen's study revealed that 9 out of 80 (11 %) women and 5 out of 50 (10 %) women reported an influence of diabetes on the capacity to reach an orgasm.¹⁴ Newman and Bertelson found evidence of orgasmic dysfunction in 15 % of a diabetic group¹⁸ and Tyrer and Schreiner-Engel failed to find significant differences in frequency of orgasm during sexual intercourse between diabetic and control groups.^{15,17}

Dyspareunia

Definition

Dyspareunia refers to 'a recurrent or persistent genital pain with sexual intercourse. This disturbance is not caused exclusively by vaginismus or lack of lubrication and is not due exclusively to the direct physiological effects of a substance'.⁹

Findings in Research on Orgasm

Dyspareunia is one of the studied variables in six studies^{10,14,15,17,18,22} and is referred to in different ways: dyspareunia, some pain and discomfort in sexual intercourse or vaginal pain in coitus. All authors used questionnaires to ask women about eventually experienced genital pain during sexual intercourse. Newman and Bertelson found that 21 % of diabetic patients reported some genital pain. It has been hypothesized that the higher prevalence of dyspareunia in women with diabetes may be partially explained by a higher prevalence of vaginal infections and/or a decrease of vaginal lubrication.¹⁸ But these results are not in agreement with other studies in which only 3 %, ¹⁰ 10 %, ^{14,17} 12 %, ¹⁵ and 16 %²² of diabetic women reported dyspareunia. Jensen found that 10 % (8/80) of women with diabetes reported dyspareunia in comparison to 7.5 % (3/40) in the control group.¹⁴ Tyrer found similar results: 12 % in the diabetic and 4 % in the control group¹⁵ and Schreiner-Engel failed to find differences between diabetic (10 %) and non-diabetic (2 %) women in vaginal burning, itching or pain during coitus.¹⁷

Etiology

Sexual problems are mostly multi-factorial. The sexual response cycle depends on normal functioning of circulatory, endocrine, vascular, and psychic mechanisms.³³ Notwithstanding the similarity between sexual dysfunctions in women and men with diabetes as shown in this review there is still a disparity in aetiological explanations between male and female sexual dysfunction. In men a major cause of organic impotence is diabetic autonomic neuropathy, often reinforced by anti-hypertensive medication and vasculopathy.^{34,35} Since there is analogy between the anatomical and nervous basis for sexual functioning in men and women,¹² it can be expected that autonomic neuropathy is also an important aetio-

logical factor in women. However, Ellenberg concluded that there was no difference in sexual dysfunction between women with and without diabetic neuropathy.¹² Jensen found that peripheral but not autonomic neuropathy was correlated with sexual dysfunction in women (and men).^{14,16} A comparison of diabetic women with borderline symptomatic and/or no autonomic neuropathy revealed no statistical differences between these groups.¹⁵ However, women with symptomatic autonomic neuropathy were slightly less likely to experience strong sexual arousal during sexual intercourse. Campbell also failed to find a significant relationship between the presence of neuropathy and sexual dysfunction and Jensen reported

that some sexually dysfunctional women recovered normal function, in spite of objective evidence of neuropathy.²² In contrast, Leedom found that women with neuropathy report significantly more symptoms of sexual dysfunction in comparison to non-neuropathic diabetic or control women.²⁴ One study mentioned the use of anatomo-pathological research of neurovascular changes in female genitalia and found lesions in clitoral nerves similar to those in the corpora nervosa in impotent men.¹³ However, this study has not been replicated. Tyrer therefore suggested that there may be sex differences, not yet understood, in the way the autonomic nervous system controls male and female genital responses.¹⁵ As opposed

Table 2. Effect of diabetes on female sexuality

Name	Sexual desire	Excitement	Orgasm	Dyspareunia
Kolodny	no effect	in 14 % difficulties in vaginal lubrication	anorgasmy in 36 % (6 % in controls)	3 % had dyspareunia ($\frac{1}{2}$ due to vaginitis)
Montenero	no effect	sensibility affected in 27 %	decrease or absence of orgasm in 1 %	
Ellenberg	no effect (decrease in 14 %)		decrease or absence of orgasm in 18 %	
Zrustova and Rostlapil	decrease in 45 %	lack of sensibility in 45 %	anorgasmy in 33 %	
Jensen	decrease in 20 %	in 24 % problems with excitement	influence on orgasm in 11 %	10 % of the patients with diabetes
Tyrer	no significant trend of decrease	in 34 % problems with arousal	no differences between diabetic patients and controls	12 % had pain or discomfort (not significantly different from controls)
Jensen	decrease in 24 %	reduced vaginal lubrication in 18 %	orgasmic dysfunction in 19 %	10 % had pain during coitus (not significantly different from controls)
Schreiner-Engel	significantly less desire	decrease in lubrication in 45 %	no differences between diabetic patients and controls	
Jensen		reduced vaginal lubrication in 18 %	orgasmic dysfunction in 14 %	
Newman and Bertelson	decrease in 21 %	problems with lubrication in 32 %	orgasmic dysfunction in 15 %	21 % reported some genital pain
Schreiner-Engel	Type 2 significantly less desire	Type 2 significantly more difficulty in lubrication	anorgasmy in 32 % of patients with Type 2 diabetes	
Campbell	decrease in 23 %	in 29 % deficient lubrication	anorgasmy in 23 %	dyspareunia in 16 %
Slob		no differences in objective or in subjective data		
Leedom	women with neuropathy significantly less desire	women with neuropathy have significantly more problems with lubrication	women with neuropathy have more problems with orgasm	
Wincze		objectively less lubrication; subjectively no differences		

to studies in men, the relation with peripheral vascular disease or treatment with anti-hypertensive or other medication has never been reported.

It should be emphasized that the presence of diabetes (or diabetic complications) and sexual dysfunction in one person does not necessarily imply an aetiological relationship.³⁶ However, in chronic diseases there is a tendency to become excessively preoccupied with the physiology of sex and to forget that a sexual encounter is more than spinal reflexes.¹² Although it is important to exclude a biological factor in every patient, other aetiological factors should not be neglected. The possible correlation of sexual problems with psychological factors,^{14,16,27} depression,^{14,18,24,37} and relational aspects^{15,18,21} have been studied. Since women focus more on the subjective quality of their relationships, it is important to take all these variables into account if one wants to give an opinion on the aetiology of sexual dysfunction in women with diabetes.

Conclusions and Discussion

The deleterious effects of diabetes on sexual function in men have long been recognized and are well-documented in, for example, Veves *et al.*³⁴, Askeney *et al.*³⁵, Tattersall³⁶, Schiavi³⁸, Webster³⁹, Close and Ryder⁴⁰. Diabetes is a known cause of male erectile failure and an important part of this is attributable to neurological factors.^{34,35} As diabetic women run the same risk to develop neuropathy, it might be expected that this condition should also influence female sexual functioning. However, the available data for such an influence are scarce. A reason for this might be the tendency to ignore the sexual implications of physical illness in women¹⁵ or the difficulties posed by the quantification of sexuality in women.^{10,14,28,31} Nevertheless, this review on the influence of diabetes on female sexuality shows a certain evolution. Since the mid 1980s, studies have improved methodologically and the focus has widened to the whole sexual response cycle; to the (possible) correlation between sexual problems and both diabetic control and diabetic complications; and to psychological components in the development of sexual dysfunctions in diabetic patients.

On first sight, the small number of studies on the effect of diabetes on female sexuality carried out during the past 25 years has led to fragmentary and inconclusive results. However, in our opinion Schreiner-Engel's statement that 'the fundamental question about the expected impairment of the arousal phase, as occurs in diabetic men, has not been fully answered'⁸ is now superseded. Stating that there are no problems of arousal in women with diabetes seems to us to neglect the evidence of most studies (see Table 2). Based upon the results shown in Table 2, it is our opinion that there is evidence for the presence of sexual problems in diabetic women. Diabetic women may experience decreased sexual desire and more pain on sexual intercourse, but they are especially at risk of decreased sexual arousal, with slow

Table 3. Comparison of the specific influence of diabetes on sexual dysfunctions in women and men

Sexual desire	Sexual arousal	Orgasm
<i>Man</i>		
Some influence on sexual desire possible	problems with erection: – in 50 % of diabetic men ^{37,38} – 5 times more than in the normal population	– retrograde ejaculation – partial ejaculation incompetence
<i>Woman</i>		
Some influence on sexual desire possible	problems with vaginal lubrication: – in 30 % of diabetic women – 2 times more than in the normal population	– no influence

and/or inadequate lubrication. There is a lack of evidence that problems with orgasm are more frequent in diabetic women. Based upon these results, we can formulate the hypothesis that diabetic women have, in analogy with men, a specific pattern of sexual dysfunctions in which the arousal phase especially is affected (Table 3). Although there is a growing consensus that diabetic autonomic neuropathy is responsible for the sexual problems of men, the arguments are lacking that it has the same influence in women.

Further research can be stimulated by our hypothesis. It needs to be improved methodologically as suggested above. Longitudinal studies are needed that take into account: type of diabetes; age; presence of complications; measures of diabetic control; disease acceptance; quality of life; psychological well-being (e.g. depression) and quality of relationships; objective and subjective measures of sexual functioning. Larger sample sizes should be used and control groups should be incorporated. In this way, the influence of diabetes on sexual functioning of diabetic women can be better understood and clinical guidelines for treatment can be developed. As an important part of human life, sexuality should be an integral part of the challenge to improve the quality of life of diabetic patients. The knowledge that women with diabetes are at risk for sexual problems should be an invitation to consider this in consultations. In this way physicians can adjust the treatment of this chronic disease to all the needs of diabetic women.

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